



NUCLEAR REGULATORY COMMISSION

[Docket Nos. 50-289 and 50-320; NRC-2021-0069]

Exelon Generation Company, LLC; TMI-2 Solutions, LLC; Three Mile Island

Nuclear Station, Units 1 and 2

AGENCY: Nuclear Regulatory Commission.

ACTION: Exemptions; issuance.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) has issued exemptions in response to a request to reduce the required level of primary offsite liability insurance from \$450 million to \$100 million and to eliminate the requirement to carry secondary financial protection for Three Mile Island Nuclear Station, Unit 1 and to reduce the required level of primary offsite liability insurance in the event of an extraordinary nuclear occurrence from \$200 million to \$100 million for Three Mile Island Nuclear Station, Unit 2.

DATES: The exemptions were issued on March 9, 2021.

ADDRESSES: Please refer to Docket ID **NRC-2021-0069** when contacting the NRC about the availability of information regarding this document. You may obtain publicly available information related to this document using any of the following methods:

- **Federal Rulemaking Web Site:** Go to <https://www.regulations.gov> and search for Docket ID **NRC-2021-0069**. Address questions about Docket IDs in Regulations.gov to Stacy Schumann; telephone: 301-415-0624; e-mail: Stacy.Schumann@nrc.gov. For technical questions, contact the individual listed in the **FOR FURTHER INFORMATION CONTACT** section of this document.

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301-415-4737, or by e-mail to pdr.resource@nrc.gov. The ADAMS accession number for each document referenced (if it is available in ADAMS) is provided the first time that it is mentioned in this document.

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FOR FURTHER INFORMATION CONTACT: Theodore Smith, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; telephone: 301-415-6721, e-mail: Theodore.Smith@nrc.gov.

SUPPLEMENTARY INFORMATION: The text of the exemptions is attached.

Dated: March 11, 2021.

For the Nuclear Regulatory Commission.

Bruce A. Watson,
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Reactor Decommissioning Branch,
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NUCLEAR REGULATORY COMMISSION

Docket Nos. 50-289 and 50-320

Exelon Generation Company, LLC

TMI-2 Solutions, LLC

Three Mile Island Nuclear Station, Units 1 and 2

Exemptions

I. Background.

By letter dated June 20, 2017 (Agencywide Documents Access and Management System [ADAMS] Accession No. Main Library [ML] ML17171A151), Exelon Generation Company, LLC (Exelon) certified to the U.S. Nuclear Regulatory Commission (NRC, the Commission) that it planned to permanently cease power operations at Three Mile Island Nuclear Station, Unit 1 (TMI-1) on or about September 30, 2019. On September 20, 2019, Exelon permanently ceased power operations at TMI-1. By letter dated September 26, 2019 (ADAMS Accession No. ML19269E480), Exelon certified to the NRC that the fuel was permanently removed from the TMI-1 reactor vessel and placed in the spent fuel pool (SFP) as of September 26, 2019. Accordingly, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.82(a)(2), the TMI-1 renewed facility operating license no longer authorizes operation of the reactor or emplacement or retention of fuel in the reactor vessel. The facility is still authorized to possess and store irradiated (i.e., spent) nuclear fuel. Spent fuel is currently stored onsite at the TMI-1 facility in the SFP.

Three Mile Island Nuclear Station, Unit 2 (TMI-2) was a 2,770 megawatts thermal pressurized light-water reactor supplied by Babcock & Wilcox that was issued an operating license on February 8, 1978 and began commercial operations on December 30, 1978. On March 28, 1979, TMI-2 experienced an accident that resulted in severe

damage to the reactor core. Subsequently, approximately 99 percent of the fuel and damaged core material was removed from the TMI-2 reactor vessel and associated systems and shipped to the U.S. Department of Energy Idaho National Laboratory. After the completion of accident recovery operations, TMI-2 was placed in a Post-Defueling Monitored Storage (PDMS) state on September 14, 1993, with a possession only license that authorizes the possession of byproduct and special nuclear materials but not the operation of the reactor.

Following the TMI-2 accident, in 1982, the NRC granted an exemption from the requirements of 10 CFR 140.11(a)(4) for TMI-1 and TMI-2 (ML19141A211). The exemption allowed the licensees to provide two endorsements to meet the financial protection requirements of subsection 170 of the Atomic Energy Act of 1954, as amended. The first endorsement, Endorsement No. 43, restored the limits of liability to the amounts listed in other endorsements upon an “extraordinary nuclear occurrence” (ENO) being declared by the NRC arising out of the ownership, operation, maintenance, or use of TMI-1 and/or TMI-2. The second endorsement, Endorsement No. 44 , increased the TMI-1 liability limit to the NRC limit in effect at the time for any bodily injury or property damages caused by a nuclear energy hazard, but increased the TMI-2 liability limit only in the event the NRC declared an ENO on or after May 1, 1979. Subsequently, in 1994, the NRC granted TMI-2 an exemption from participation in secondary financial protection (ADAMS Accession No. 9408050260 [Legacy Library]). The exemptions herein do not impact the exemptions already in place.

II. Request/Action.

By letter dated January 3, 2020 (ADAMS Accession No. ML20003E096), Exelon requested an exemption from 10 CFR 140.11(a)(4) to reduce the required level of primary offsite liability insurance from \$450 million to \$100 million and to eliminate the requirement to carry secondary financial protection for TMI-1 and TMI-2 Solutions, LLC

(TMI-2 Solutions)¹ requested an exemption from 10 CFR 140.11(a)(4) to reduce the required level of primary offsite liability insurance in the event of an ENO² from \$200 million to \$100 million for TMI-2.

The regulation at 10 CFR 140.11(a)(4) requires each licensee to have and maintain primary financial protection in an amount of \$450 million. In addition, the licensee is required to participate in an industry retrospective rating plan (secondary financial protection) that commits each licensee to pay into an insurance pool to be used for damages that may exceed primary insurance coverage. Participation in the industry retrospective rating plan will subject the licensee to deferred premium charges up to a maximum total deferred premium of \$131,056,000 with respect to any nuclear incident at any operating nuclear power plant and up to a maximum annual deferred premium of \$20,496,000 per incident.

Many of the accident scenarios postulated in the updated safety analysis reports for operating power reactors involve failures or malfunctions of systems, which could affect the fuel in the reactor core and, in the most severe postulated accidents, would involve the release of large quantities of fission products. With the permanent cessation of power operations at TMI-1 and the permanent removal of the fuel from the reactor vessel, and the PDMS state of TMI-2 with no fuel assemblies in the TMI-2 reactor or the TMI-2 SFP, many accidents are no longer possible. Similarly, the associated risk of offsite liability damages that would require insurance or indemnification is commensurately lower for such plants. Therefore, Exelon requested an exemption from 10 CFR 140.11(a)(4) to permit a reduction in primary offsite liability insurance and to withdraw from participation in the industry retrospective rating plan for TMI-1. Additionally, TMI-2 Solutions requested an exemption from 10 CFR 140.11(a)(4) to permit a reduction in primary offsite liability insurance to \$100 million in the event of an ENO for TMI-2.

¹ The TMI-2 license was transferred to TMI-2 Solutions on December 18, 2020 (ADAMS Accession No. ML20352A381).

² Pursuant to 10 CFR 140.83, if the Commission determines that both of the criteria set forth in 10 CFR 140.84 and 140.85 have been met, it will make the determination that there has been an ENO.

III. Discussion.

Pursuant to 10 CFR 140.8, "Specific exemptions," the Commission may, upon application of any interested person or upon its own initiative, grant such exemptions from the requirements of the regulations in 10 CFR part 140 when the exemptions are authorized by law and are otherwise in the public interest. The NRC staff has reviewed the licensees' request for exemptions from 10 CFR 140.11(a)(4) and has concluded that the requested exemptions are authorized by law and are otherwise in the public interest.

The Price Anderson Act of 1957 (PAA) requires that nuclear power reactor licensees have insurance to compensate the public for damages arising from a nuclear incident. Specifically, the PAA requires licensees of facilities with a "rated capacity of 100,000 electrical kilowatts or more" to maintain the maximum amount of primary offsite liability insurance commercially available (currently \$450 million) and a specified amount of secondary insurance coverage (currently up to \$131,056,000 per reactor). In the event of an accident causing offsite damages in excess of \$450 million, each licensee would be assessed a prorated share of the excess damages, up to \$131,056,000 per reactor, for a total of approximately \$13 billion per nuclear incident. The NRC's regulations at 10 CFR 140.11(a)(4) implement these PAA insurance requirements and set forth the amount of primary and secondary insurance each power reactor licensee must have.

As noted above, the PAA requirements with respect to primary and secondary insurance and the implementing regulations at 10 CFR 140.11(a)(4) apply to licensees of facilities with a "rated capacity of 100,000 electrical kilowatts or more." In accordance with 10 CFR 50.82(a)(2), the license for a power reactor no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel upon the docketing of the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel, or when a final legally effective order to permanently cease operations has come into effect. Therefore, the reactor cannot be used to generate power.

Accordingly, a reactor that is undergoing decommissioning has no “rated capacity.” Thus, the NRC may take the reactor licensee out of the category of reactor licensees that are required to maintain the maximum available insurance and to participate in the secondary retrospective insurance pool.

The financial protection limits of 10 CFR 140.11(a)(4) were established to require a licensee to maintain sufficient insurance, as specified under the PAA, to satisfy liability claims by members of the public for personal injury, property damage, and the legal cost associated with lawsuits as the result of a nuclear accident at an operating reactor with a rated capacity of 100,000 kilowatts electric or greater. Thus, the insurance levels established by this regulation, as required by the PAA, were associated with the risks and potential consequences of an accident at an operating reactor with a rated capacity of 100,000 kilowatts electric or greater.

The legal and associated technical basis for granting exemptions from 10 CFR part 140 is set forth in SECY-93-127, “Financial Protection Required of Licensees of Large Nuclear Power Plants During Decommissioning,” dated May 10, 1993 (ADAMS Accession No. ML12257A628). The legal analysis underlying SECY-93-127 concluded that, upon a technical finding that lesser potential hazards exist after permanent cessation of power operations (and the reactor having no “rated capacity”), the Commission has the discretion under the PAA to reduce the amount of insurance required of a licensee undergoing decommissioning.

As a technical matter, the fact that a reactor has permanently ceased power operations is not itself determinative as to whether a licensee may cease providing the offsite liability coverage required by the PAA and 10 CFR 140.11(a)(4). In light of the presence of freshly discharged irradiated fuel in the SFP at a recently shut down reactor, the potential for an offsite radiological release from a zirconium fire with consequences comparable in some respects to an operating reactor accident remains. That risk is very low at the time of reactor shut down because of design provisions that prevent a significant reduction in coolant inventory in the SFP under normal and accident

conditions and becomes no longer credible once the continual reduction in decay heat provides ample time to restore coolant inventory and permits air-cooling in a drained SFP. After that time, the probability of a large offsite radiological release from a zirconium fire is negligible for permanently shut down reactors, but the SFP is still operational and an inventory of radioactive materials still exists onsite. Therefore, an evaluation of the potential for offsite damage is necessary to determine the appropriate level of offsite insurance post shut down, in accordance with the Commission's discretionary authority under the PAA to establish an appropriate level of required financial protection for such permanently shut down facilities.

The NRC staff has conducted an evaluation and concluded that, aside from the handling, storage, and transportation of spent fuel and radioactive materials for a permanently shut down and defueled reactor, no reasonably conceivable potential accident exists that could cause significant offsite damage. During normal power reactor operations, the forced flow of water through the reactor coolant system (RCS) removes heat generated by the reactor. The RCS transfers this heat away from the reactor core by converting reactor feedwater to steam, which then flows to the main turbine generator to produce electricity. Most of the accident scenarios postulated for operating power reactors involve failures or malfunctions of systems that could affect the fuel in the reactor core, which in the most severe postulated accidents would involve the release of large quantities of fission products. With the permanent cessation of reactor operations at the TMI site and the permanent removal of the fuel from the reactor core, such accidents are no longer possible. The reactor, RCS, and supporting systems no longer operate and have no function related to the storage of the irradiated fuel. Therefore, postulated accidents involving failure or malfunction of the reactor, RCS, or supporting systems are no longer applicable.

During reactor decommissioning, the principal radiological risks are associated with the storage of spent fuel onsite. On a case-by-case basis, licensees undergoing decommissioning have been granted permission to reduce the required amount of

primary offsite liability insurance coverage from \$450 million to \$100 million and to withdraw from the secondary insurance pool. One of the technical criteria for granting the exemption is that the possibility of a design-basis event that could cause significant offsite damage has been eliminated.

In its exemption request, Exelon described both design-basis and beyond-design-basis events involving irradiated fuel stored in the TMI-1 SFP. Exelon stated, and the NRC staff agrees, that while spent fuel remains in the SFP, the only postulated design-basis accident that would remain applicable to TMI-1 in the permanently defueled condition that could contribute a significant dose is a fuel handling accident (FHA) in the Reactor Building, where the SFP is located. For completeness, the NRC staff also evaluated the applicability of other design-basis accidents documented in the TMI-1 Updated Final Safety Analysis Report (UFSAR) (ADAMS Package Accession No. ML18117A343) to ensure that these accidents would not have consequences that could potentially exceed the 10 CFR 50.67 dose limits and Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," dose acceptance criteria or approach the U.S. Environmental Protection Agency (EPA) early phase protective action guides (PAGs).

In the TMI-1 UFSAR, the licensee has determined that 365 days after shut down, the FHA doses would decrease to a level that would not warrant protective actions under the EPA early phase PAG framework, notwithstanding meeting the dose limit requirements under 10 CFR 50.67 and dose acceptance criteria under Regulatory Guide 1.183. The NRC staff notes that the doses from an FHA are dominated by the isotope Iodine-131. TMI-1 permanently ceased power operations on September 20, 2019. With 488 days of decay, the thyroid dose from an FHA would be negligible and the only isotope remaining in significant amounts, among those postulated to be released in a design-basis FHA, would be Krypton-85. Since Krypton-85 primarily decays by beta emission, the calculated skin dose from an FHA analysis would make an insignificant contribution to the total effective dose equivalent, which is the parameter of interest in

the determination of the EPA early phase PAGs for sheltering or evacuation. The NRC staff concludes that the dose consequence from an FHA for the permanently shut down TMI-1 would not approach the EPA early phase PAGs. Therefore, any offsite consequence from a design-basis radiological release is highly unlikely and, thus, a significant amount of offsite liability insurance coverage is not required.

The only beyond design-basis event that has the potential to lead to a significant radiological release at a permanently shut down and defueled reactor is a zirconium fire. The zirconium fire scenario is a postulated, but highly unlikely, accident scenario that involves the loss of water inventory from the SFP resulting in a significant heat up of the spent fuel and culminating in substantial zirconium cladding oxidation and fuel damage. The probability of a zirconium fire scenario is related to the decay heat of the irradiated fuel stored in the SFP. Therefore, the risks from a zirconium fire scenario continue to decrease as a function of the time that TMI-1 has been permanently shut down.

In the analysis provided in Attachment 2, "Three Mile Island Nuclear Station Zirconium Fire Analysis for Drained Spent Fuel Pool (Calculation C-1101-202-E410-476, Revision 1)," to the letter dated July 1, 2019 (ADAMS Accession No. ML19182A104), the licensee compared the conditions for the hottest fuel assembly stored in the SFP to a criterion proposed in SECY-99-168, "Improving Decommissioning Regulations for Nuclear Power Plants," dated June 30, 1999 (ADAMS Accession No. ML12265A598), applicable to offsite emergency response for the unit in the decommissioning process. This criterion considers the time for the hottest assembly to heat up from 30 degrees Celsius ($^{\circ}\text{C}$) to 900 $^{\circ}\text{C}$ adiabatically. If the heat up time is greater than 10 hours, then offsite emergency preplanning involving the plant is not necessary. Based on the limiting fuel assembly for decay heat and adiabatic heat up analysis presented in Attachment 2, at 488 days (approximately 16 months) after permanent cessation of power operations, the time for the hottest fuel assembly to reach 900 $^{\circ}\text{C}$ is 10 hours after the assemblies have been uncovered. As stated in NUREG-1738, "Technical Study of Spent Fuel Pool Accident

Risk at Decommissioning Nuclear Power Plants,” dated February 2001 (ADAMS Accession No. ML010430066), 900 °C is an acceptable temperature to use for assessing onset of fission product release under transient conditions to establish the critical decay time for determining the availability of 10 hours for deployment of mitigation equipment and, if necessary, for offsite agencies to take appropriate action to protect the health and safety of the public if fuel and cladding oxidation occurs in air.

The NRC staff reviewed the calculation to verify that important physical properties of materials were within acceptable ranges and the results were accurate. The NRC staff determined that physical properties were appropriate and completed independent confirmatory calculations that produced similar results. Therefore, the NRC staff found that after 488 days of decay, at least 10 hours would be available before a significant offsite release could begin. The NRC staff concluded that the adiabatic heat up calculation provided an acceptable method for determining the minimum time available for deployment of mitigation equipment and, if necessary, implementing measures under a comprehensive general emergency plan.

In this regard, one technical criterion for relieving decommissioning reactor licensees from the insurance obligations applicable to an operating reactor is a finding that the heat generated by the SFP has decayed to the point where the possibility of a zirconium fire is highly unlikely. This was addressed in SECY-93-127, where the NRC staff concluded that there was a low likelihood and reduced short-term public health consequences of a zirconium fire once a decommissioning plant's spent fuel has sufficiently decayed. In its Staff Requirements Memorandum, “Financial Protection Required of Licensees of Large Nuclear Power Plants during Decommissioning,” dated July 13, 1993 (ADAMS Accession No. ML003760936), the Commission approved a policy that authorized, through the exemption process, withdrawal from participation in the secondary insurance layer and a reduction in commercial liability insurance coverage to \$100 million when a licensee is able to demonstrate that the spent fuel could be air-cooled if the SFP was drained of water.

The NRC staff has used this technical criterion to grant similar exemptions to other decommissioning reactors (e.g., Maine Yankee Atomic Power Station, published in the *Federal Register* (FR) on January 19, 1999 (64 FR 2920); Zion Nuclear Power Station, published in the *Federal Register* on December 28, 1999 (64 FR 72700); Kewaunee Power Station, published in the *Federal Register* on March 24, 2015 (80 FR 15638); Crystal River Unit 3 Nuclear Generation Plant, published in the *Federal Register* on May 6, 2015 (80 FR 26100); Oyster Creek Nuclear Generating Station, published in the *Federal Register* on December 28, 2018 (83 FR 67365); and Pilgrim Nuclear Power Station, published in the *Federal Register* on January 13, 2020 (85 FR 1827)).

Additional discussions of other decommissioning reactor licensees that have received exemptions to reduce their primary insurance level to \$100 million are provided in SECY-96-256, "Changes to the Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors, 10 CFR 50.54(w) and 10 CFR 140.11," dated December 17, 1996 (ADAMS Accession No. ML15062A483). These prior exemptions were based on the licensee demonstrating that the SFP could be air-cooled consistent with the technical criterion discussed above.

The NRC staff has evaluated the issue of zirconium fires in SFPs and presented an independent evaluation of an SFP subject to a severe earthquake in NUREG-2161, "Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a U.S. Mark I Boiling Water Reactor," dated September 2014 (ADAMS Accession No. ML14255A365). This evaluation concluded that, for a representative boiling-water reactor, fuel in a dispersed high-density configuration would be adequately cooled by natural circulation air flow within several months after discharge from a reactor if the pool was drained of water.

In its exemption request, Exelon compared TMI-1 fuel storage parameters with those used in NRC generic evaluations of fuel cooling included in NUREG/CR-6451, "A Safety and Regulatory Assessment of Generic BWR [Boiling-Water Reactor] and PWR

[Pressurized-Water Reactor] Permanently Shut down Nuclear Power Plants,” dated August 1997 (ADAMS Accession No. ML082260098). The analysis described in NUREG/CR-6451 determined that natural air circulation would adequately cool fuel that has decayed for 17 months after operation in a typical PWR, which is a slightly longer decay time than the zirconium fire period of 488 days on which the TMI-1 exemption request is based. In order to evaluate if the TMI-1 decay period was conservative, Exelon examined the decay heat at TMI-1 and determined that the average fuel assembly decay heat for the most recently offloaded TMI-1 spent fuel at 488 days after shut down will be approximately 3 percent less than the decay heat for the average fuel assembly at 519 days for the representative PWR plant in NUREG/CR-6451.

A comparison of the parameters for the fuel assembly power, power density, and hydraulic resistance of the 15x15 fuel assemblies at TMI-1 indicated that these parameters are less than those of the 17x17 fuel assemblies modeled in NUREG/CR-6451. Therefore, the NUREG/CR-6451 fuel assembly model is conservative for TMI-1. The SFP rack configuration was also evaluated and found to be conservative for TMI-1. The configuration/hydraulic resistance of the TMI-1 downcomers and plenum underneath the SFP storage racks is bounded by that modeled in NUREG/CR-6451. Additionally, the hydraulic resistance of the SFP rack loaded cells is less than that of the SFP rack configuration modeled in NUREG/CR-6451. The bottom orifices on all TMI-1 SFP racks are equal to or larger than those modeled in NUREG/CR-6451, which also makes the estimates for TMI-1 more conservative.

As a result of the comparison, Exelon concluded that the TMI-1 SFP conditions are bounded by the NUGREG/CR-6451 benchmark and that the TMI-1 spent fuel would be air-coolable at 488 days after permanent shut down. Therefore, at 16 months after permanent shut down, the NRC staff has reasonable assurance that fuel stored in the TMI-1 SFP would be adequately air-cooled in the unlikely event the SFP completely drained.

In SECY-00-0145, "Integrated Rulemaking Plan for Nuclear Power Plant Decommissioning," dated June 28, 2000, and SECY-01-0100, "Policy Issues Related to Safeguards, Insurance, and Emergency Preparedness Regulations at Decommissioning Nuclear Power Plants Storing Fuel in Spent Fuel Pools," dated June 4, 2001 (ADAMS Accession Nos. ML003721626 and ML011450420, respectively), the NRC staff discussed additional information concerning SFP zirconium fire risks at decommissioning reactors and associated implications for offsite insurance. Analyzing when the spent fuel stored in the SFP is capable of adequate air-cooling is one measure that demonstrates when the probability of a zirconium fire would be exceedingly low.

In addition, the licensee performed adiabatic heat up analyses to determine a dose rate curve at the Exclusion Area Boundary (EAB) and Control Room. Although the analysis described above demonstrated that a significant release of radioactive material from the spent fuel in the absence of water cooling is not possible after 488 days following permanent cessation of power operations, the potential exists for radiation exposure to an offsite individual in the event that shielding of the fuel is lost. The site-specific offsite and Control Room radiological impacts of a postulated complete loss of SFP water were assessed in TMI-1 Technical Evaluation 623073, "TMI Spent Fuel Pool Draindown Shine Dose Rate Evaluation, Revision 0." With a decay of 365 days from shut down, the dose rate at the EAB would be 4.04×10^{-1} mrem/hour not crediting the shielding from the Fuel Handling Building (FHB) roof. Crediting the FHB roof structure, the dose rate at the EAB would be 4.6×10^{-10} mrem/hour.

The licensee's adiabatic heat up analyses demonstrate that 16 months after the permanent cessation of operations, there would be at least 10 hours to take mitigative actions in response to events that could lead to a zirconium fire. In addition, the TMI-1 SFP conditions were determined to be bounded by the analysis of the NUREG/CR-6451 benchmark demonstrating that the SFP would be air-coolable at 488 days after permanent cessation of operations.

In its exemption request, Exelon furnished the following information: “Because of the length of time it would take for the adiabatic heat up to occur, there is ample time to respond (≥ 10 hours) to any drain down event that might cause such an occurrence by restoring [SFP] cooling or makeup or providing [SFP] spray. As a result, the likelihood that such a scenario would progress to a zirconium fire is not deemed credible.”

In the NRC staff’s evaluation contained in SECY-20-0041, “Request by Exelon Generation Company, LLC for Exemptions from Certain Emergency Planning Requirements for the Three Mile Island Nuclear Station,” dated May 5, 2020 (ADAMS Accession No. ML19311C763), the NRC staff assessed the Exelon accident analyses associated with the radiological risks from a zirconium fire at a permanently shut down and defueled TMI site. For the highly unlikely beyond design-basis accident scenario where the SFP coolant inventory is lost in such a manner that all methods of heat removal from the spent fuel are no longer available, the NRC staff found that there will be a minimum of 10 hours from the initiation of the accident until the cladding reaches a temperature where offsite radiological release might occur. The NRC staff finds that 10 hours is sufficient time to support deployment of mitigation equipment, consistent with plant conditions, to prevent the zirconium cladding from reaching a point of rapid oxidation.

The NRC staff has determined that the licensee’s proposed reduction in primary offsite liability coverage to a level of \$100 million and the licensee’s proposed withdrawal from participation in the secondary insurance pool for offsite financial protection are consistent with the policy established in SECY-93-127 and subsequent insurance considerations resulting from zirconium fire risks, as discussed in SECY-00-0145 and SECY-01-0100. The NRC has previously determined in SECY-00-0145 that the minimum offsite financial protection requirement may be reduced to \$100 million and that secondary insurance is not required once it is determined that the spent fuel in the SFP is no longer thermal-hydraulically capable of sustaining a zirconium fire based on a plant-specific analysis. In addition, the NRC staff notes that similar exemptions from

these insurance requirements have been granted to other permanently shut down and defueled power reactors upon satisfactory demonstration that zirconium fire risk from the irradiated fuel stored in the SFP is of negligible concern.

As provided in SECY-93-127, the NRC staff included in its recommendations that using the standards set forth in SECY-93-127, primary financial protection could be reduced to \$100 million for nuclear power plants that have had the requisite spent fuel cooling period. However, as specifically mentioned in SECY-93-127 (Note 5), for TMI-2 “primary financial protection covering the site will remain at \$200 million [the full required regulatory value at the time of the issuance of SECY-93-127] because there is at least one other operating reactor on [the] site.” Since TMI-1 is no longer authorized to operate, there is no longer at least one other operating reactor on the TMI site. Therefore, TMI-2 Solutions requested a corresponding exemption from 10 CFR 140.11(a)(4) for TMI-2 to permanently reduce the required level of primary offsite liability insurance for ENOs from \$200 million to \$100 million. As discussed above, TMI-2 is maintained in a PDMS state with a possession only license that authorizes the possession of byproduct and special nuclear materials but not the operation of the reactor.

The NRC staff evaluated the applicability of a waste gas tank rupture as documented in the TMI-1 UFSAR, and the applicability of any unanticipated releases as documented in the Unanticipated Events Analysis in the TMI-2 Post-Defueling Monitored Storage Safety Analysis Report (ADAMS Package Accession No. ML17236A295), to ensure that these accidents would not have consequences that could potentially exceed the 10 CFR 50.67 dose limits and Regulatory Guide 1.183 dose acceptance criteria or approach the EPA early phase PAGs. Exelon stated that the bounding event for TMI-2 is a fire in the Reactor Building with the Reactor Building Purge System in operation. The NRC staff reviewed the assumptions, inputs, and methods used by Exelon to assess the radiological impacts of the requested exemption. The NRC staff concludes that Exelon has demonstrated that the dose consequences for postulated accidents at

the permanently defueled TMI facility would not have consequences that could potentially exceed the applicable dose limits in 10 CFR 100.11, "Determination of exclusion area, low population zone, and population center distance," and 10 CFR 50.67, and the dose acceptance criteria in Regulatory Guide 1.183. The analysis demonstrates that 365 days after permanent cessation of power operations, the radiological consequences of the analyzed design-basis accidents will not exceed the limits of the EPA early phase PAGs at the EAB. Therefore, the NRC staff finds the requested exemption to be acceptable from a dose consequence perspective.

The most significant accident sequence for a permanently defueled and shut down reactor involves the complete loss of water from the spent fuel pool. As the NRC previously recognized when issuing an exemption for TMI-2 from the requirement to participate in secondary financial protection, this accident scenario is not credible or reasonably conceivable at TMI-2 since the spent fuel pool is drained and no spent fuel is stored in the pool. Since TMI-2 is being maintained in a PDMS state with the reactor defueled and no fuel in the TMI-2 SFP, TMI-2 meets the criterion established in SECY-93-127 for relief from the requirements to maintain primary offsite liability insurance for ENOs at a level above \$100 million. As discussed previously, TMI-2 has already received an exemption from participation in the secondary retrospective insurance pool. Because the criteria presented in SECY-93-127 for removal from the secondary financial protection requirement are identical to those for reducing the primary offsite liability insurance, there is precedent for allowing the reduction of offsite liability insurance for TMI (as a site), once TMI-1 has met the criteria in SECY-93-127. In addition, the NRC staff notes that similar exemptions from these insurance requirements have been granted to other permanently shut down and defueled power reactors, upon satisfactory demonstration that zirconium fire risk from the irradiated fuel stored in the SFP is of negligible concern.

A. The Exemptions are Authorized by Law

The PAA and its implementing regulations in 10 CFR 140.11(a)(4) require licensees of nuclear reactors that have a rated capacity of 100,000 kilowatts electric or more to have and maintain \$450 million in primary financial protection and to participate in a secondary retrospective insurance pool. In accordance with 10 CFR 140.8, the Commission may grant exemptions from the regulations in 10 CFR part 140 as the Commission determines are authorized by law. The legal and associated technical basis for granting exemptions from 10 CFR part 140 are set forth in SECY-93-127. The legal analysis underlying SECY-93-127 concluded that, upon a technical finding that lesser potential hazards exist after permanent cessation of operations, the Commission has the discretion under the PAA to reduce the amount of insurance required of a licensee undergoing decommissioning.

Based on its review of the exemption requests, the NRC staff concludes that the technical criteria for relieving Exelon and TMI-2 Solutions from their existing primary and/or secondary insurance obligations have been met. As explained above, the NRC staff found that no reasonably conceivable design-basis accident exists that could cause an offsite release greater than the EPA PAGs and, therefore, that any offsite consequence from a design-basis radiological release is highly unlikely and the need for a significant amount of offsite liability insurance coverage is unwarranted. Additionally, the NRC staff determined that, after 16 months decay, the fuel stored in the TMI-1 SFP will be capable of being adequately cooled by air in the highly unlikely event of pool drainage. Moreover, in the highly unlikely beyond design-basis accident scenario where the SFP coolant inventory is lost in such a manner that all methods of heat removal from the spent fuel are no longer available, the NRC staff has determined that at least 10 hours would be available and is sufficient time to support deployment of mitigation equipment, consistent with plant conditions, to prevent the zirconium cladding from reaching a point of rapid oxidation. Thus, the NRC staff concludes that the fuel stored in the TMI-1 SFP will have decayed sufficiently by the requested effective date for the

exemptions of 16 months after permanent cessation of power operations to support a reduction in the required insurance consistent with SECY-00-0145. Moreover, since the criteria presented in SECY-93-127 for removal from the secondary financial protection requirement are identical to those for reducing the primary offsite liability insurance, there is precedent for allowing the reduction of offsite liability insurance for TMI (as a site), once TMI-1 has met the criteria in SECY-93-127.

The NRC staff has determined that granting the licensees' proposed exemptions will not result in a violation of the Atomic Energy Act of 1954, Section 170, or other laws, as amended, which require licensees to maintain adequate financial protection. Accordingly, consistent with the legal standard presented in SECY-93-127, under which decommissioning reactor licensees may be relieved of the requirements to carry the maximum amount of insurance available and to participate in the secondary retrospective premium pool where there is sufficient technical justification, the NRC staff concludes that the requested exemptions are authorized by law.

B. The Exemptions are Otherwise in the Public Interest

The financial protection limits of 10 CFR 140.11 were established to require licensees to maintain sufficient offsite liability insurance to ensure adequate funding for offsite liability claims following an accident at an operating reactor. However, the regulation does not consider the reduced potential for and consequence of nuclear incidents at permanently shut down and decommissioning reactors.

The basis provided in SECY-93-127, SECY-00-0145, and SECY-01-0100 allows licensees of decommissioning plants to reduce their primary offsite liability insurance and to withdraw from participation in the retrospective rating pool for deferred premium charges. As discussed in these documents, once the zirconium fire concern is determined to be negligible, possible accident scenario risks at permanently shut down and defueled reactors are greatly reduced when compared to the risks at operating reactors and the associated potential for offsite financial liabilities from an accident are commensurately less. The licensee analyzed and the NRC staff confirmed that the risks

of accidents that could result in an offsite radiological risk are minimal, thereby justifying the proposed reductions in offsite primary liability insurance and withdrawal from participation in the secondary retrospective rating pool for deferred premium charges.

Additionally, participation in the secondary retrospective rating pool could potentially have adverse consequences on the safe and timely completion of decommissioning. If a nuclear incident sufficient to trigger the secondary insurance layer occurred at another nuclear power plant, the licensee could incur financial liability of up to \$131,056,000. However, because TMI is permanently shut down, it cannot produce revenue from electricity generation sales to cover such a liability. Therefore, such liability if subsequently incurred could significantly affect the ability of the facility to conduct and complete timely radiological decontamination and decommissioning activities. In addition, as SECY-93-127 concluded, the shared financial risk exposure to the licensee is greatly disproportionate to the radiological risk posed by TMI when compared to operating reactors. The reduced overall risk to the public at decommissioning power plants does not warrant that the licensee be required to carry full operating reactor insurance coverage after the requisite spent fuel cooling period has elapsed following final reactor shut down. The licensee's proposed financial protection limits will maintain a level of liability insurance coverage commensurate with the risk to the public. These changes are consistent with previous NRC policy as discussed in SECY-00-0145 and exemptions approved for other decommissioning reactors. Thus, the underlying purpose of the regulations will not be adversely affected by the reductions in insurance coverage. Accordingly, an exemption from participation in the secondary insurance pool (for TMI-1) and a reduction in the primary insurance to \$100 million (for TMI-1 and TMI-2), a value more in line with the potential consequences of accidents, would be in the public interest in that this ensures that there will be adequate funds to address any of those consequences and helps to ensure the safe and timely decommissioning of the reactor.

Therefore, the NRC staff has concluded that the requested exemptions from 10 CFR 140.11(a)(4) at the requested effective date of 16 months after the permanent cessation of power operations, are in the public interest.

C. Environmental Considerations

The NRC's approval of an exemption from insurance or indemnity requirements belongs to a category of actions that the Commission, by rule or regulation, has declared to be a categorical exclusion after first finding that the category of actions does not individually or cumulatively have a significant effect on the human environment. Specifically, the exemption is categorically excluded from the requirement to prepare an environmental assessment or environmental impact statement in accordance with 10 CFR 51.22(c)(25).

Under 10 CFR 51.22(c)(25), granting of an exemption from the requirements of any regulation of Chapter I to 10 CFR is a categorical exclusion provided that: (i) there is no significant hazards consideration; (ii) there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite; (iii) there is no significant increase in individual or cumulative public or occupational radiation exposure; (iv) there is no significant construction impact; (v) there is no significant increase in the potential for or consequences from radiological accidents; and (vi) the requirements from which an exemption is sought involve surety, insurance, or indemnity requirements.

As the Director, Division of Decommissioning, Uranium Recovery, and Waste Programs, Office of Nuclear Material Safety and Safeguards, I have determined that approval of the exemption request involves no significant hazards consideration, as defined in 10 CFR 50.92, because reducing a licensee's offsite liability requirements at TMI does not: (1) involve a significant increase in the probability or consequences of an accident previously evaluated;

(2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. The

exempted financial protection regulation is unrelated to the operation of TMI or site activities. Accordingly, there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite and no significant increase in individual or cumulative public or occupational radiation exposure. The exempted regulation is not associated with construction so there is no significant construction impact. The exempted regulation does not concern the source term (i.e., potential amount of radiation in an accident) nor any activities conducted at the site. Therefore, there is no significant increase in the potential for, or consequences of, a radiological accident. In addition, there would be no significant impacts to biota, water resources, historic properties, cultural resources, or socioeconomic conditions in the region resulting from issuance of the requested exemptions. The requirement for offsite liability insurance involves surety, insurance, or indemnity matters only.

Therefore, pursuant to 10 CFR 51.22(b) and 51.22(c)(25), no environmental impact statement or environmental assessment need be prepared in connection with the approval of this exemption request.

IV. Conclusions.

Accordingly, the Commission has determined that, pursuant to 10 CFR 140.8, the requested exemptions are authorized by law and are otherwise in the public interest. Therefore, the Commission hereby grants Exelon and TMI-2 Solutions exemptions from the requirements of 10 CFR 140.11(a)(4) for the TMI site. TMI-1 permanently ceased power operations on September 20, 2019. The exemptions from 10 CFR 140.11(a)(4) permit TMI-1 to reduce the required level of primary financial protection from \$450 million to \$100 million and to withdraw from participation in the secondary layer of financial protection 16 months after the permanent cessation of power operations. Further, the exemptions permit TMI-2 relief from the requirements to maintain primary offsite liability insurance for ENOs at a level above \$100 million.

The exemptions are effective as of 16 months after permanent cessation of power operations.

Dated, this 9th day of March, 2021.

For the Nuclear Regulatory Commission.

Patricia K. Holahan, Director,
Division of Decommissioning, Uranium Recovery,
and Waste Programs,
Office of Nuclear Material Safety
and Safeguards.

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